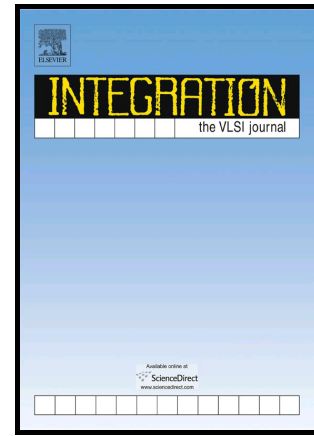


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# A Generalized Numerical Method for Ferrite Inductors Analysis in High Current Ripple Operation

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## Abstract

Ferrite Core Power Inductors (FCPIs) operation in partial saturation offers unexplored opportunities in reducing the size of magnetic parts and the power losses in Switching Mode Power Supplies (SMPSs). This paper presents an enhanced numerical method to achieve a reliable prediction of the current ripple of FCPIs, also in partial saturation, for different conversion topologies and in whatever operating conditions. The proposed analysis includes High-Current Ripple (HCR) operations, for synchronous configurations in Continuous Conduction Mode (CCM) and for diode rectification configurations in Discontinuous Conduction Mode (DCM). Relevant numerical algorithms for the reliable FCPIs current wave-shape prediction are given. Experimental verifications are performed on two boost converters in CCM and DCM to provide the validation of the proposed method.

**Keywords** — Ferrite Inductors; Saturation; High Current Ripple; Continuous Conduction Mode; Discontinuous Conduction Mode; Numerical Methods; Differential Evolution; Identification Algorithms.

## NOMENCLATURE

CCM	Continuous Conduction Mode
DCM	Discontinuous Conduction Mode
$V_{in}$	input voltage
$V_{out}$	output voltage
$I_{out}$	output current
$Q_0$	converter control switch
$Q_1$	converter synchronous switch
$D_0$	converter diode
$D$	$Q_0$ duty-cycle in CCM
$D_1$	$Q_0$ duty-cycle in DCM
$D_2$	$D_0$ duty-cycle in DCM
$f_s$	switching frequency

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